Physics

Year 10

The general education high school Physics and Astronomy course aims at:

- instilling in pupils the system of physical and astronomic knowledge based on the modern theories (scientific facts, notions, theoretical models, laws, and principles), and development of the ability to use the acquired knowledge in cognitive practice;
- acquiring by pupils of the methodology of natural and scientific cognition, and scientific way of thinking;
- learning by pupils of the main methods and algorithms of simple and complicated task solving by different methods using the laws of physics and other natural sciences;
- teaching pupils the generalized experimental skills of natural and scientific research by scientific cognition (planning of the experiment, selection of the research method, measurement, processing and interpretation of the obtained results);
- teaching pupils the skills of cognitive activities during the process of studying Physics and Astronomy.

Course structure (3 hrs per week; 105 hrs in total)

Content of educational material	The expected academic performance of a pupil
Introduction	
Worldview potential of natural sciences. The role of knowledge on physics and astronomy in the life of a human and social development. Initial details on the fundamental physical theories as the basis of the modern physical science. Astronomy as a natural science. Main stages of development and physics and astronomy. Physics as a theoretical basis of modern astronomy.	Characterizes physics and astronomy as natural sciences; gives examples of fundamental physical theories; defines the main stages of historical development of physics and astronomy. Assesses the impact of Ukrainian physics and astronomic sciences, and renowned Ukrainian scientists in the development of modern natural sciences.
Section 1. Mechanics	
Mechanical movement. The main tasks of mechanics and ways of describing the body movements. Even and uneven straight movement. Relativity of movement. Law of added velocities. Acceleration. Uniform acceleration. Graphs of dependence of kinematic values on time for even and uniform straight movement acceleration.	Explains the main concepts and laws, principles of mechanics and special relativity provisions, formulas to define the physical values, mathematic expressions of the laws of mechanics, the essence of Galileo's and Einstein's principle of relativity, relativity of length and time, relativity of simultaneous events in the moveable and motionless frame of reference, and spatiotemporal features of the physical world.

Straight movement of a material dot in circles. Radial acceleration. Angle and linear velocity, relation between these velocities. Forces in mechanics. Inertial frames of reference. Galileo's principle of relativity. Mass. Newton's laws and their application for task-solving. Gravitation relation. Law of universal gravity. Force of gravity and body weight. Body movement in the field of force of gravity. Free fall. Body movement under several forces. Archimedes' principle. Body equilibrium. Moment of force. Conditions of body equilibrium. Center of gravity and body mass center. Impulse, impulse law. Kinetic and potential energy. Power. Law of conservation of mechanical energy. Use of conservation laws in mechanics. Limits of application of the classic mechanics laws. Special relativity provisions and consequences thereof. Relativist law of added velocities.	Defines the conditions whereby the mechanical energy and impulse are maintained; body equilibrium; limits of application of mechanics laws. Observes and describes different types of mechanical movement and mechanical relations of bodies in nature and machines. Solves tasks on: - functional dependence between the physical values on: even and uniform acceleration on a straight, relative movement, even movement in circles, movement under several forces, application of Newton's, Archimedes', and universal gravity laws; law of conservation (of energy and impulse). Experimentally studies the features of different types of movement, checks the laws of movement and conservation; and measures strengths. Can provide a graphic presentation of functional dependence of the description of mechanic movement and relation.
Section 2. Molecular physics and thermodynamics	
Modern study of the structure of substance. Atoms and molecules. Atom structure. Nanomaterials. Basics of the molecular-kinetic theory of the structure of substances. Ideal gas. Gas pressure. The main equation of the molecular-kinetic theory of ideal gas. Absolute scale of temperature. Ideal gas condition equation. Isoprocesses. Internal energy of bodies. Quantity of warmth. Thermodynamic process. First law of thermodynamics. Adiabatic change. Heat engines. Work principle of heat engines. Heat engines cycle. Heat engines efficiency. Irreversibility of heat processes. Entropy. Features of saturated and non-saturated vapor. Air humidity.	Understands the following terms and concepts: atoms and molecules, quantity of substance, atom core, nanomaterials, main equation of molecular-kinetic theory (MKT); ideal gas, gas pressure, gas laws, the main MKT equation; ideal gas condition equation, isoprocesses; internal energy, gas work, first law of thermodynamics; saturated and non-saturated vapor, absolute and relative air humidity; superficial tension of liquids, wetting, capillary phenomena; mechanical stress, Hooke's law, Young's module. Explains: graininess of substances, main provisions of MKT; features of substance aggregate conditions based on MKT, thermodynamic and molecular-kinetic temperature content, main equation of

Superficial tension of liquids. Wetting. Capillary phenomena. Deformations. Mechanic features of solid bodies. Young's module.	molecular-kinetic theory, gas laws, entropy as the feature of direction and irreversibility of processes in the system; application of first law of thermodynamics to isoprocesses, principles of action of heat engines, features of fluids, gases and solid bodies, their phase shifts, dependence of the pressure and density of the saturated vapor on the temperature, capillarity and wetting, and diagram of substance condition. Builds and analyzes the graphs of isoprocesses; Experimentally studies isoprocesses, defines the air humidity and superficial tension of substance.